

Rec'd PCT/PTO 28 MAR 2002


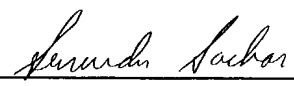
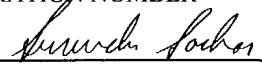
FORM PTO-1390 (Modified) (REV 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER <b>221194US6XPCT</b>	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <b>10/088507</b>	
				PRIORITY DATE CLAIMED <b>28 SEPTEMBER 1999</b>	
INTERNATIONAL APPLICATION NO. <b>PCT/FR00/02656</b>		INTERNATIONAL FILING DATE <b>26 SEPTEMBER 2000</b>			
TITLE OF INVENTION <b>DELIVERY VALVE DEVICE FOR REFRIGERANT COMPRESSOR</b>					
APPLICANT(S) FOR DO/EO/US <b>Philippe FRANCOIS</b>					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.</li> <li>4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is attached hereto.</li> <li>b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ol> </li> <li>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input type="checkbox"/> have been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input checked="" type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).</li> <li>10. <input checked="" type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).</li> <li>11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).</li> <li>12. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).</li> </ol>					
<p><b>Items 13 to 20 below concern document(s) or information included:</b></p> <ol style="list-style-type: none"> <li>13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>15. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment.</li> <li>16. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li>17. <input type="checkbox"/> A substitute specification.</li> <li>18. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>19. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</li> <li>20. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</li> <li>21. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</li> <li>22. <input type="checkbox"/> Certificate of Mailing by Express Mail</li> <li>23. <input checked="" type="checkbox"/> Other items or information:</li> </ol> <p><b>Notice of Priority / PCT/IB/304 / PCT/IB/308</b>  <b>PTO-1449 / Drawings (4 sheets)</b>  <b>Amended Sheets (pages 2, 2a, 6, 8, 9, 10, and page 4 of drawings)</b></p>					

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.492 (a)(1) - (5)) : <div style="font-size: 24pt; font-weight: bold; text-align: center;">10/088507</div>	INTERNATIONAL APPLICATION NO <div style="font-weight: bold; text-align: center;">PCT/FR00/02656</div>	ATTORNEY'S DOCKET NUMBER <div style="font-weight: bold; text-align: center;">221194US6XPCT</div>
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24. The following fees are submitted: <b>BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5)) :</b>				CALCULATIONS PTO USE ONLY	
<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO . . . . .				\$1040.00	
<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO . . . . .				\$890.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO . . . . .				\$740.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) . . . . .				\$710.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) . . . . .				\$100.00	
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	11 - 20 =	0	x \$18.00	\$0.00	
Independent claims	1 - 3 =	0	x \$84.00	\$0.00	
Multiple Dependent Claims (check if applicable).				\$0.00	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$890.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				\$0.00	
<b>SUBTOTAL =</b>				\$890.00	
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
<b>TOTAL NATIONAL FEE =</b>				\$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				\$0.00	
<b>TOTAL FEES ENCLOSED =</b>				\$890.00	
				Amount to be: refunded	\$
				charged	\$

- a. ☒ A check in the amount of \$890.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 15-0030 A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:  <div style="border: 1px solid black; padding: 10px; text-align: center;">   <div style="font-size: 24pt; font-weight: bold;">22850</div>  <b>Surinder Sachar</b>  <b>Registration No. 34,423</b> </div> <div style="margin-top: 10px;"> <b>(703) 413-3000</b> </div>	<div style="text-align: center;">           SIGNATURE   <b>Gregory J. Maier</b>          NAME   <b>25,599</b>          REGISTRATION NUMBER             DATE       </div>
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221194US

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: :  
PHILIPPE FRANCOIS :  
SERIAL NO: NEW U.S. PCT APPLN. : ATTN: APPLICATION BRANCH  
(Based on PCT/FR00/02656)  
FILED: HEREWITH :  
FOR: DELIVERY VALVE DEVICE FOR  
REFRIGERANT COMPRESSOR

PRELIMINARY AMENDMENT

ASSISTANT COMMISSIONER FOR PATENTS  
WASHINGTON, D.C. 20231

SIR:

Prior to a first examination on the merits, please amend the above-identified application as follows:

IN THE CLAIMS

Please cancel Claims 1-11 without prejudice.

Please add new Claims 12-22 as follows:

12. (New) A delivery valve device for a refrigerant compressor comprising:  
a valve plate pierced with at least one fluid delivery passage;  
at least one delivery valve closing said at least one fluid delivery passage on a  
downstream side in a direction of delivery of the fluid, and secured, at one of its ends, to the  
valve plate by first fixing means; and  
at least one delivery valve stop;

wherein said at least one delivery valve is held at its other end, in almost permanent sliding contact with the valve plate by a spring secured to the valve plate by second fixing means.

13. (New) The delivery valve device as claimed in claim 12, wherein said spring includes an elastic leaf fixed at one end to the valve plate by said second fixing means and pressing, toward its other end, the at least one delivery valve onto the valve plate.

14. (New) The delivery valve device as claimed in claim 13, wherein said first and second fixing means at a same time fix said at least one delivery valve stop to the valve plate so that the valve stop clamps the at least one delivery valve and the spring onto the valve plate at the first and second fixing means.

15. (New) The delivery valve device as claimed in claim 12, wherein said first and second fixing means include rivets.

16. (New) The delivery valve device as claimed in claim 12, further comprising pegs fixed into the valve plate to prevent the at least one delivery valve and said spring from rotating.

17. (New) The delivery valve device and as claimed in claim 12, comprising two delivery valves closing two passages in the valve plate, wherein said spring is a single spring for the two delivery valves and said stop is a single stop for the two delivery valves.

18. (New) The delivery valve device as claimed in claim 17, wherein said spring is in a shape of a U with branches that respectively press free ends of the two delivery valves against the valve plate and a central part of which is fixed to the valve plate by said second fixing means, and wherein said at least one delivery valve stop is in a shape of a U with branches acting as respective stops for the delivery two valves, ends of which are fixed to the

valve plate by said first fixing means and a central part of which is fixed to the valve plate by said second fixing means.

19. (New) The delivery valve device as claimed in claim 12, wherein said fixing means and said at least one delivery valve and said spring are configured to, at a same time, prevent the at least one delivery valve and the spring from rotating.

20. (New) The delivery valve device as claimed in claim 19, wherein the fixing means includes rivets collaborating with fixing orifices in said at least one delivery valve and the spring, the fixing orifices having a cross-section of a non-circular shape.

21. (New) The delivery valve device as claimed in claim 20, wherein said shape of the cross-section of the fixing orifices is star shaped.

22. (New) The delivery valve device as claimed in claim 12, wherein said at least one delivery valve has a part of reduced width in a region of lesser stress to adapt to a stiffness of said at least one delivery valve.

#### IN THE ABSTRACT

Please delete the original Abstract on page 11 in its entirety and insert therefor:

#### **ABSTRACT**

A delivery valve device for a refrigerant compressor. The delivery valve device include a valve plate with the delivery passage closed by a delivery valve fixed at one end to the valve plate and pressed against this valve plate at its free end by a spring. A valve stop is fixed with the delivery valve and the spring to the valve plate to clamp one end of the delivery valve and of the spring onto the valve plate using rivets. The sliding contact of the free end of the delivery valve on the plate avoids valve bounce and flutter. Such a delivery valve may reduce the noise level in refrigeration compressors.

REMARKS

Favorable consideration of this application, as presently amended, is respectfully requested.

The present preliminary amendment is submitted to place the above-identified application in more proper format under United States practice.

By the present preliminary amendment original Claims 1-11 are cancelled and new Claims 12-22 are presented for examination. New Claims 12-22 are deemed to be self-evident from the original disclosure, including original Claims 1-11, and thus are not deemed to raise any issue of new matter. Further, new Claims 12-22 are not believed to be more narrow in scope in any aspect in comparison with original Claims 1-11.

A new Abstract believed to be in more proper format under United States practice is also submitted herein.

The present application is believed to be in condition for a full and thorough examination on the merits. An early and favorable consideration of the present application is hereby respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



Gregory J. Maier  
Registration No. 25,599  
Attorney of Record  
Surinder Sachar  
Registration No. 34,423



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<b>Marked-Up Copy</b> Serial No:  Amendment Filed on: <u>3-28-2002</u>
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IN THE CLAIMS

Claims 1-11 (Cancelled).

Claims 12-22 (New).

IN THE ABSTRACT

(New)



JC13 Rec'd PCT/PTO 28 MAR 2002

DOCKET NO.: 221194 US

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

IN RE APPLICATION OF: Philippe FRANCOIS

SERIAL NO.: NEW U.S. PCT APPLICATION

FILED: HERewith

INTERNATIONAL APPLICATION NO.: PCT/FR00/02656

INTERNATIONAL FILING DATE: September 26, 2000

FOR: DELIVERY VALVE DEVICE FOR REFRIGERANT COMPRESSOR

**REQUEST FOR PRIORITY UNDER 35 U.S.C. 119  
AND THE INTERNATIONAL CONVENTION**Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

In the matter of the above-identified application for patent, notice is hereby given that the applicant claims as priority:

<b><u>COUNTRY</u></b>	<b><u>APPLICATION NO</u></b>	<b><u>DAY/MONTH/YEAR</u></b>
France	99 12071	28 September 1999

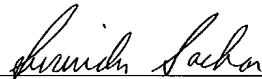
Certified copies of the corresponding Convention application(s) were submitted to the International Bureau in PCT Application No. PCT/FR00/02656. Receipt of the certified copy(s) by the International Bureau in a timely manner under PCT Rule 17.1(a) has been acknowledged as evidenced by the attached PCT/IB/304.

Respectfully submitted,  
OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



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Gregory J. Maier  
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Surinder Sachar  
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## DELIVERY VALVE DEVICE FOR REFRIGERANT COMPRESSOR

5 The invention relates to a delivery valve device for a  
refrigerant compressor.

Refrigerant compressors of various types, for example reciprocating or rotary compressors, are known, particularly hermetically sealed motor-driven compressors for domestic or commercial refrigeration and air conditioning. All these compressors have the function of compressing a refrigerant fluid.

15 The general principle of such compressors is  
illustrated in Figure 1, which schematically depicts,  
in a cylinder, a piston 19, a valve plate 11 and a  
cylinder head comprising two chambers 16 and 18. The  
walls of the cylinder, the piston 19 and the valve  
20 plate 11 delimit a compression/expansion chamber 15.  
The valve plate 11 has an intake passage 110, between  
the compression/expansion chamber 15 and the intake  
chamber 16, and a delivery passage 111 between the  
chamber 15 and the delivery chamber 18. An intake valve  
25 12 is positioned on the valve plate 11 and pressed  
against it. During the intake phase, the valve 12 opens  
under the effect of the pressure difference between the  
compression/expansion chamber 15, which increases in  
volume because of the retreating movement of the piston  
30 (here assumed to be of the reciprocating type), and the  
intake chamber 16. The movement of the intake valve is  
limited by a stop 17. At the end of the intake phase,  
the valve 12 closes again against the valve plate,  
sealing the passage 110 against fluid when compression  
35 begins.

A delivery valve 13 is positioned on the valve plate 11 and pressed against it. It is generally built in at one end and free at the other end. During the delivery

- 2. -

Phase, the valve 13 opens under the effect of the pressure difference between the chamber 15, where the fluid is compressed under the effect of the piston 19, and the delivery chamber 18. The movement of the delivery valve 13 is limited by a delivery vave stop 14 against which the valve 13 comes into contact. At the end of the delivery phase, the delivery valve 13 closes again against the valve plate 11, sealing against the reflux of the fluid through the passage 111.

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In fact, it is found that the operation of the valves explained herein above is more complicated than that. In particular, the intake and delivery valves generally open several times during a given phase in the cycle and experience a fluttering movement between the valve plate and the stop. This flutter leads to metal-to-metal impact which generates noise and greatly increases the noise level of the compressor, particularly as far as the delivery valve is concerned.

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A valve device of this type is described for example in American patent US 5 110 272. Therein can be found all the elements described above. The problem that this device sets out to solve is that of giving the delivery valves sufficient flexibility while at the same time keeping its axial bulk to an acceptable level. This is achieved by providing a L-shaped valve. However, this valve lifts a great way off the valve plate when it opens, and is therefore subject to the flutter described above and to the ensuing disadvantages.

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The object of the invention is to appreciably reduce the noise level of the compressor by limiting the impact due to the delivery valve.

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The subject of the invention is therefore a delivery valve device which overcomes the drawbacks described herein above by virtue of a modification to the

AMENDED SHEET

-2a-

principle of the valve on the delivery side which consists in keeping the delivery valve in constant contact, at both ends, with the valve plate.

- 5 According to the invention, there is therefore provided a delivery valve device for a refrigerant compressor of the type comprising a valve plate pierced with at least one fluid delivery passage, at least one delivery valve closing said passage on the downstream side in the  
10 direction of delivery of the fluid, and secured, at one of its ends, to the valve plate by first fixing the means and at least one delivery valve stop, said device being characterized in

that said delivery valve is secured, at one of its ends, to the valve plate by first fixing means and is held at its other end, in almost permanent sliding contact with the valve plate by a spring secured to the valve plate by second fixing means.

By virtue of the fact that the valve stressing spring allows it to slide but not to lift off the valve plate, there is no bounce and flutter of the valve, hence reducing the noise level.

Another important advantage of the device according to the invention is the increase in the refrigeration capacity of the compressor, for the same cylinder capacity, through the limiting of the effects of delayed closure of the delivery valve.

The invention will be better understood and other features and advantages will become apparent through the description below and the appended drawings in which:

- Figure 1 is an outline diagram of the system of valves of a known compressor;
- Figure 2 depicts, in section, the principle of a delivery valve device according to the invention;
- Figure 3 is one exemplary embodiment of the delivery valve device according to the invention, with just one valve;
- Figures 4 and 5 depict two alternative forms of a double valve device according to the invention; and
- Figure 6 is a diagram illustrating another feature of the delivery valve.

Figure 1 has already been described above.

Figure 2 illustrates the principle of the delivery valve device according to the invention. Mounted on the

valve plate 21 comprising a delivery passage 27 is a delivery valve 22. This valve is held, at one end, secured to the valve plate via fixing means such as a rivet 26 which also fixes a delivery valve stop 24. The other end of the delivery valve 22 is free but kept in constant and sliding contact with the valve plate 21 by a spring 23, preferably a leaf spring, one end of which is fixed to the valve plate and the other end of the stop 24 by other fixing means such as another rivet 26. Thus, the valve stop 24 also clamps the valve 22 and the spring 23 to the valve plate 21.

In that way, the free end of the valve can slide against the valve plate while being kept in contact with it, during opening deformation of the valve in the compressed-fluid delivery phase. By virtue of this almost permanent contact, the impacts of the valve against the stop or against the valve plate which are due to the intrinsic stiffness of the valve and to the effect of inertia after opening, are reduced considerably.

Figure 3 depicts one exemplary embodiment of the device according to the invention. The same reference numerals denote the same elements as in Figure 2. In Figure 3, in addition to the valve plate 21, the valve stop 24 and the delivery valve 22, there are also depicted the intake valve 28 and a valve plate gasket 29. Also depicted are the two fixing rivets 26 which are preferred fixing means but which could be replaced by other known means. The delivery valve 22 comprises a reduced-width part 220, of which more later, and a notch 221 to allow the passage of a peg 25 which centers the component and more particularly the valve 22 and prevents them from rotating. If necessary, another peg may be provided for immobilizing the spring 23.

The solution according to the invention thus has the

advantages of simplicity, reducing the number of components to a minimum, increasing their robustness (minimum number of drillings in the weakest components) and reducing the cost by not requiring the stop to be machined, which stop is generally a component made of sintered metal.

In certain applications, particularly commercial ones, requiring a high power, therefore a high cylinder capacity and a high fluid flow rate, there are problems of routing this flow rate with the most compact possible compressor equipment. This problem cannot be solved satisfactorily with large-diameter passages in the valve plate because it is then very difficult to house an appropriate valve. One solution therefore consists in providing two smaller passages in the valve plate, for delivery and for intake.

Figure 4 depicts one embodiment of the delivery valve device according to the invention, suited to this solution. The valve plate 21' comprises two delivery passages 27 and 27', each closed via a delivery valve 22 and 22' respectively. These valves are kept secure to the valve plate at one end. Their free end is kept in sliding contact with a plate 21' by a single U-shaped spring 23', the branches of which press respectively on the free ends of the valves and the central part of which is fixed to the valve plate by a rivet 26 which also serves to fix, in its central part, a single valve stop 24', also U-shaped. The branches of this stop are fixed at their end, together with the non-free end of the valve, by other rivets 26. The way in which each delivery valve works is strictly identical to the mode of operation of the single delivery valve of Figure 3.

For centering the various components and preventing them from rotating, there are provided, for example, three pegs 25, 25' and 25".

The other elements depicted are identical to those of Figure 3 and bear the same references.

Figure 5 depicts an alternative form of the device of Figure 4. The only modification made is the omission of the centering pegs which therefore entails a small modification to the valve plate, 21" instead of 21', the delivery valve 22.1 and 22.2 instead of 22 and 22', the spring and the stop, 23" and 24" instead of 23' and 24'.

To maintain the function of preventing the valves and the spring from rotating, it is merely envisaged for the cylindrical cross section of the holes used for fastening these to be modified so that they are no longer circular, as is usually the case, but preferably a star-shaped cross section (although other shapes would also be possible). The material of the rivets 26 which is displaced by the riveting operation occupies the star- or other-shaped volume inside the valves and the spring, thus preventing them from rotating.

It is obvious that this solution can also be adopted in the case of the exemplary embodiment with just one valve in Figure 3.

It is now necessary to return to the shape of the delivery valves, namely the use of a part of reduced width 220.

For the high fluid pressures that may be used, (when the pressure in the delivery chamber becomes very much higher than the pressure in the compression/expansion chamber) an effect of the valve being extruded through the delivery passage, somewhat like stamping in reverse, may occur when the delivery valve is in the closed position. To avoid detrimental consequences, the thickness of the valve leaf needs therefore to be



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increased, and this results in greater stiffness. To compensate for that, provision is therefore made for the width of the valve to be reduced in a region of lower stress.

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Figure 6 illustrates the principle of this feature. This figure schematically depicts the valve plate 21, the valve 22 in the open position fixed by the rivet 26 and the spring 23. It can be seen that in the open position, because of the deformation of the valve, maximum stresses are applied approximately to the zones 222 delimited by the dashes. By contrast, in a zone such as 223, delimited approximately by dotted lines, the stresses are at a minimum and the width reduction 220 can therefore be applied there.

Of course the exemplary embodiments described do not in any way limit the invention. This invention applies irrespective of the type of compressor and irrespective of the type of refrigerant used.

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the preceding claims, characterized in that it further comprises pegs (25;25';25'') fixed into the valve plate (21;21') to prevent the said delivery valve (22;22,22') and said spring (23;23') from rotating.

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6. The delivery valve device and as claimed in any one of the preceding claims, characterized in that it comprises two delivery valves (22;22') closing two passages in the valve plate (21'), in that said spring (23') is a single spring for the two valves and in that  
10 said stop (24') is a single stop for the two valves.

7. The delivery valve device as claimed in claim 6, characterized in that said spring (23') is in the shape  
15 of a U the branches of which respectively press the free ends of the valves against the valve plate and the central part of which is fixed to the valve plate by said second fixing means (26) and in that said valve stops (24') is in the shape of a U the branches of  
20 which act as respective stops for the two valves, the ends of which are fixed to the valve plate by said first fixing means (26) and the central part of which is fixed to the valve plate by said second fixing means (26).

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8. The delivery valve device as claimed in any one of claims 1 to 4 or 6 or 7, characterized in that said fixing means (26') and said delivery valve or valves (22.1,22.2) and said spring (23'') are designed to, at  
30 the same time, prevent the valve or valves and the spring from rotating.

9. The delivery valve device as claimed in claim 8, characterized in that the fixing means consist of  
35 rivets (26) collaborating with fixing orifices in said delivery valve or valves (22.1,22.2) and the spring (23'') which have a cross section of non-circular shapes.

10. The delivery valve device as claimed in claim 9, characterized in that said shape of the cross section of the orifices is star shaped.

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11. The delivery valve device as claimed in any one of the preceding claims, characterized in that said delivery valve or valves (22;22';22.1,22.2) have a part (220) of reduced width in a region of lesser stress (223) so as to adapt the stiffness of said valves.

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## ABSTRACT

DELIVERY VALVE DEVICE FOR REFRIGERANT  
COMPRESSOR

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The invention relates to a delivery valve device for a refrigerant compressor.

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The device comprises of a valve plate (21) with the delivery passage (27) closed by a delivery valve (22) fixed at one end to the valve plate and pressed against this plate at its free end by a spring (23). A valve stop (24) is fixed with the valve and the spring to the valve plate so as to clamp one end of the valve and of the spring onto the valve plate using rivets (26). The sliding contact of the free end of the valve on the plate avoids valve bounce and flutter.

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The invention applies to the reduction of the noise level in refrigeration compressors.

Figure 2.

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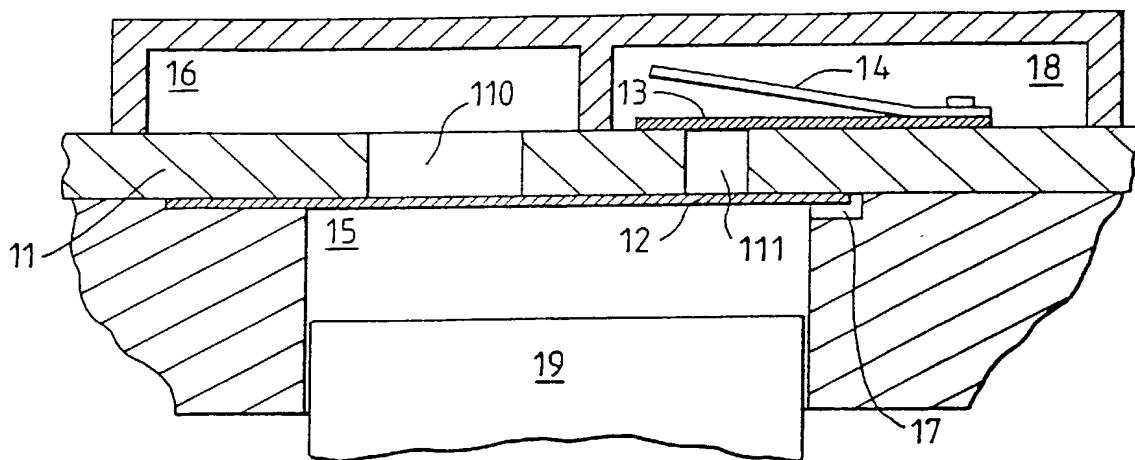


FIG. 1

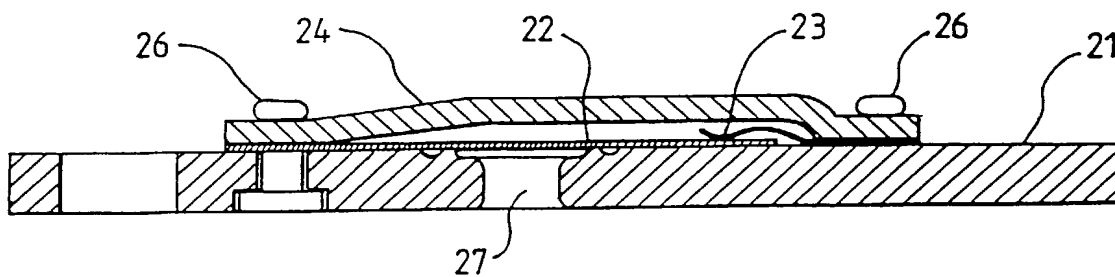


FIG. 2

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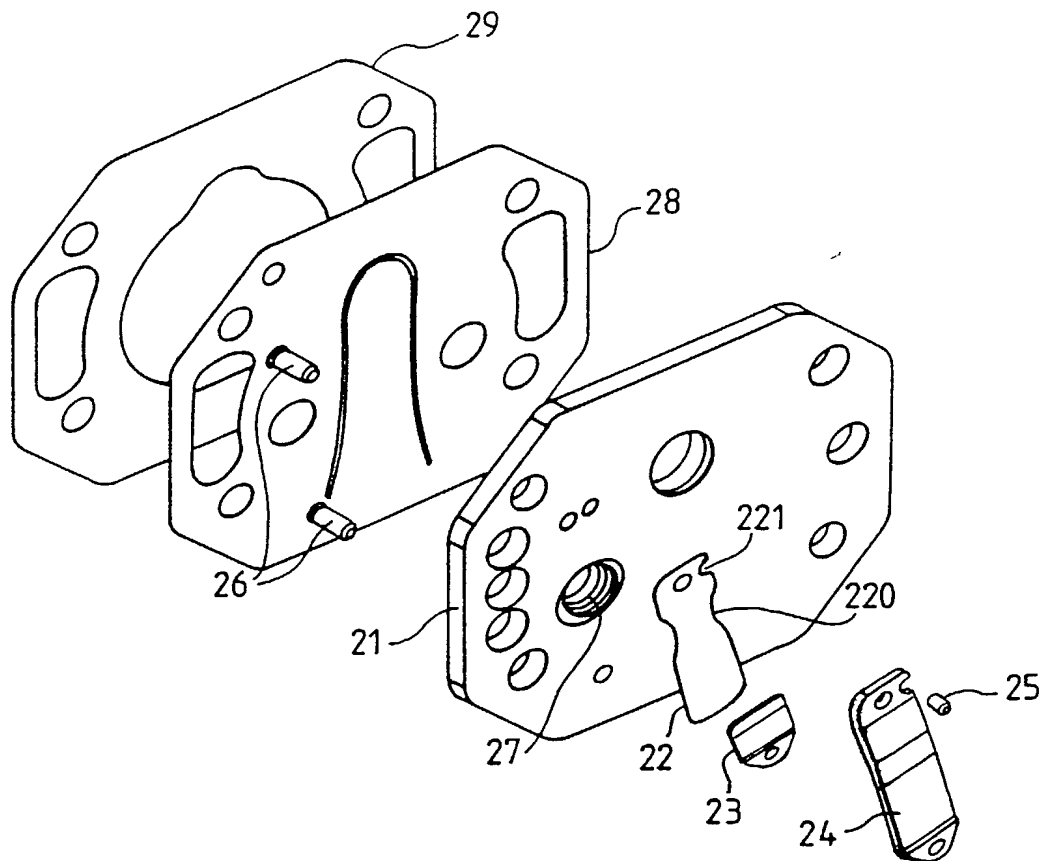


FIG.3

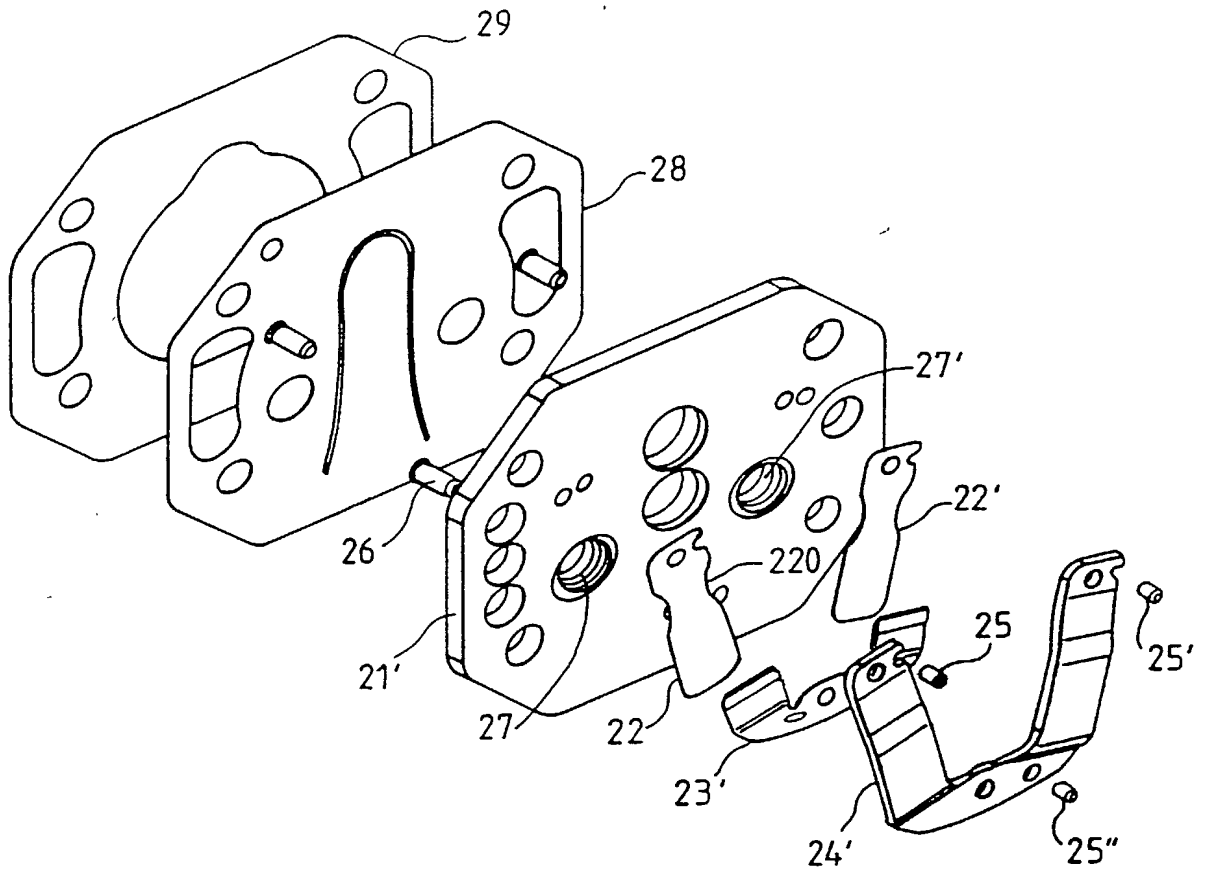


FIG. 4



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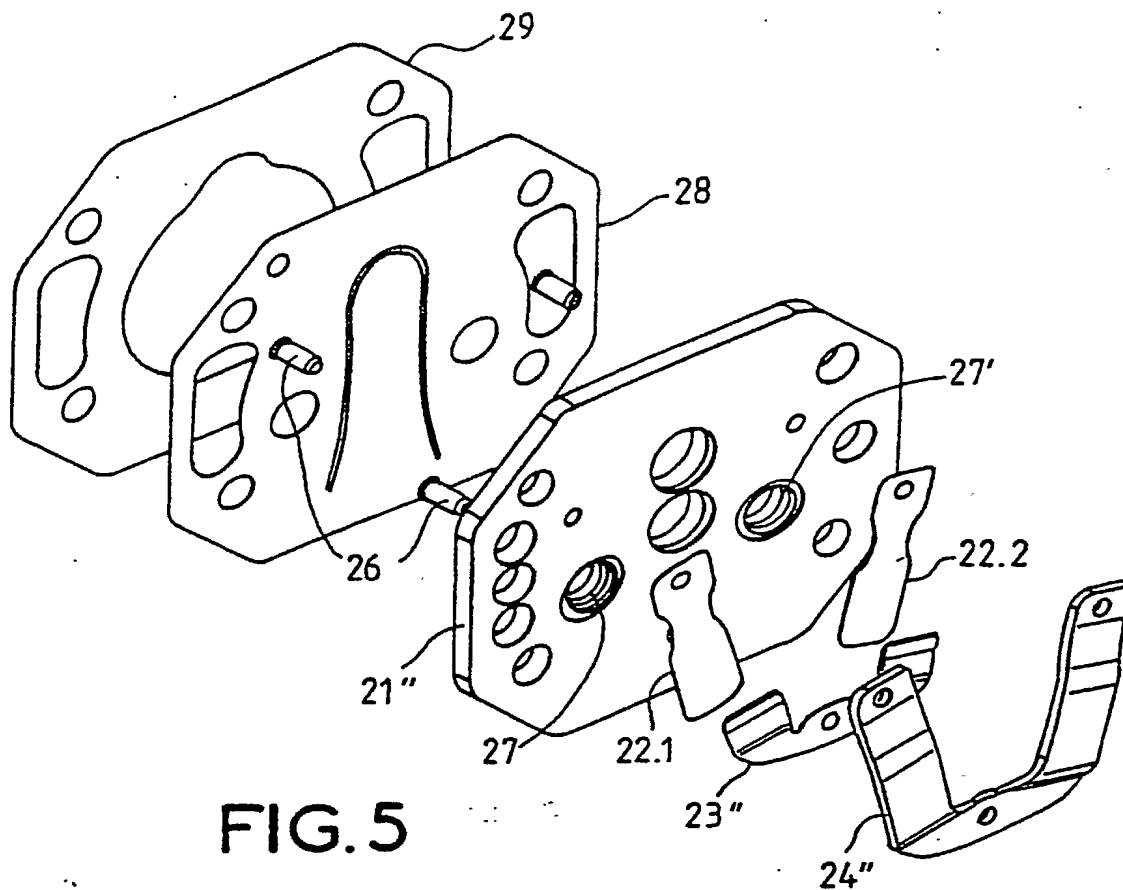


FIG. 5

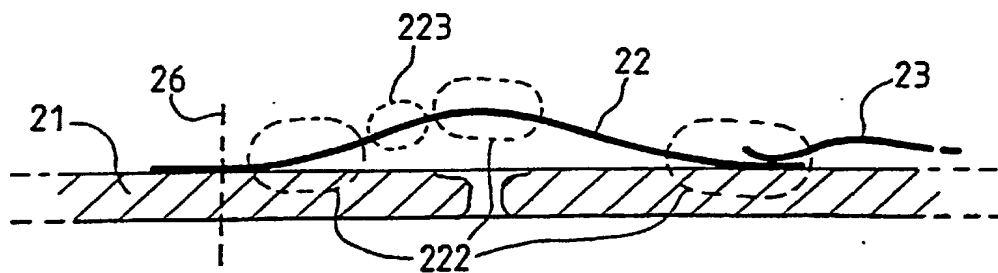


FIG. 6

# Declaration and Power of Attorney for Patent Application

## Déclaration et Pouvoirs pour Demande de Brevet

### French Language Declaration

En tant l'inventeur nommé ci-après, je déclare par le présent acte que:

Mon domicile, mon adresse postale et ma nationalité sont ceux figurant ci-dessous à côté de mon nom.

Je crois être le premier inventeur original et unique (si un seul nom est mentionné ci-dessous), ou l'un des premiers co-inventeurs originaux (si plusieurs noms sont mentionnés ci-dessous) de l'objet revendiqué, pour lequel une demande de brevet a été déposée concernant l'invention intitulée

et dont la description est fournie ci-joint

☐ ci-joint

☐ a été déposée le \_\_\_\_\_

sous le numéro de demande des Etats-Unis ou le numéro de demande international PCT

\_\_\_\_\_ et modifiée le

\_\_\_\_\_ (le cas échéant).

Je déclare par le présent acte avoir passé en revue et compris le contenu de la description ci-dessus, revendications comprises, telles que modifiées par toute modification dont il aura été fait référence ci-dessus.

Je reconnais devoir divulguer toute information pertinente à la brevetabilité, comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations.

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

#### DELIVERY VALVE DEVICE FOR REFRIGERANT COMPRESSOR

the specification of which

☐ is attached hereto.

☒ was filed on September 26, 2000

as United States Application Number or PCT International Application Number

PCT/FR00/02656 and was amended on

\_\_\_\_\_ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

## French Language Declaration

Je revendique par le présent acte avoir la priorité étrangère, en vertu du Titre 35, § 119(a)-(d) ou § 365(b) du Code des Etats-Unis, sur toute demande étrangère de brevet ou certificat d'inventeur ou, en vertu du Titre 35, § 365(a) du même Code, sur toute demande internationale PCT désignant au moins un pays autre que les Etats-Unis et figurant ci-dessous et, en cochant la case, j'ai aussi indiqué ci-dessous toute demande étrangère de brevet, tout certificat d'inventeur ou toute demande internationale PCT ayant une date de dépôt précédant celle de la demande à propos de laquelle une priorité est revendiquée.

Prior Foreign Application(s)  
Demande(s) de brevet antérieure(s) dans un autre pays.

<u>99 12071</u>	<u>FRANCE</u>
(Number)	(Country)
(Numéro)	(Pays)
(Number)	(Country)
(Numéro)	(Pays)

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 119(e) du Code des Etats-Unis, de toute demande de brevet provisoire effectuée aux Etats-Unis et figurant ci-dessous.

<u>(Application No.)</u>	<u>(Filing Date)</u>
(N° de demande)	(Date de dépôt)

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 120 du Code des Etats-Unis, de toute demande de brevet effectuée aux Etats-Unis, ou en vertu du Titre 35, § 365(c) du même Code, de toute demande internationale PCT désignant les Etats-Unis et figurant ci-dessous et, dans la mesure où l'objet de chacune des revendications de cette demande de brevet n'est pas divulgué dans la demande antérieure américaine ou internationale PCT, en vertu des dispositions du premier paragraphe du Titre 35, § 112 du Code des Etats-Unis, je reconnais devoir divulguer toute information pertinente à la brevetabilité, comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations, dont j'ai pu disposer entre la date de dépôt de la demande antérieure et la date de dépôt de la demande nationale ou internationale PCT de la présente demande:

<u>PCT/FR00/02656</u>	<u>26 September 2000</u>
(Application No.)	(Filing Date)
(N° de demande)	(Date de dépôt)
(Application No.)	(Filing Date)
(N° de demande)	(Date de dépôt)

Je déclare par le présent acte que toute déclaration ci-incluse est, à ma connaissance, véridique et que toute déclaration formulée à partir de renseignements ou de suppositions est tenue pour véridique; et de plus, que toutes ces déclarations ont été formulées en sachant que toute fausse déclaration volontaire ou son équivalent est passible d'une amende ou d'une incarcération, ou des deux, en vertu de la § 1001 du Titre 18 du Code des Etats-Unis, et que de telles déclarations volontairement fausses risquent de compromettre la validité de la demande de brevet ou du brevet délivré à partir de celle-ci.

I hereby claim foreign priority under Title 35, United States Code, § 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Priority Claimed  
Droit de priorité  
Revendiqué

<u>28 September 1999</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Day/Month/Year Filed)	Yes	No
(Jour/Mois/Année de dépôt)	Oui	Non
(Day/Month/Year Filed)	<input type="checkbox"/>	<input type="checkbox"/>
(Jour/Mois/Année de dépôt)	Yes	No
	Oui	Non

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

<u>(Application No.)</u>	<u>(Filing Date)</u>
(N° de demande)	(Date de dépôt)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

<u>(Status: Patented, Pending, Abandoned)</u>
(Statut : breveté, en cours d'examen, abandonné)

<u>(Status: Patented, Pending, Abandoned)</u>
(Statut : breveté, en cours d'examen, abandonné)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

## French Language Declaration

POUVOIRS. En tant que l'inventeur cité, je désigne par la présente l'(les) avocat(s) et/ou agent(s) suivant(s) pour qu'ils poursuive(nt) la procédure de cette demande de brevet et traite(nt) toute affaire s'y rapportant avec l'Office des brevets et des marques (mentionner le nom et le numéro d'enregistrement)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

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Nom complete du second co-inventeur, le cas echeant	Full name of second joint inventor, if any
Signature de l'inventeur	Second inventor's signature
Date	Date
Domicile	Residence
Nationalité	Citizenship
Adresse Postale	Post Office Address

(Fournier les mêmes renseignements et la signature de tout co-inventeur supplémentaire )

(Supply similar information and signature for third and subsequent joint inventors )